SYNOPSIS OF THE GRYLLOBLATTIDAE WITH THE DESCRIPTION OF A NEW SPECIES FROM OREGON (ORTHOPTERA)

BY ASHLEY BUELL GURNEY[1]

INTRODUCTION

Since Walker (1914) established the family Grylloblattidæ, some twenty-five papers have been published concerning the group. In the present study a revisionary synopsis and an evalution of taxonomic characters are offered for the first time. Two genera and five species are included, of which one species is here described as new and one genus re-established as valid. The genus *Galloisiana* Caudell is composed of two subgenera, and *Grylloblatta campodeiformis* Walker consists of two subspecies.

The present study was prompted by difficulties experienced in identifying material collected in Oregon by Prof. H. A. Scullen of the Oregon State Agricultural College. Professor Scullen kindly placed at the disposal of the writer the entire series of specimens collected by him, together with full collecting notes. Through the kindness of Dr. R. H. Beamer of the University of Kansas it has been possible to examine the entire series of *Grylloblatta campodeiformis occidentalis* Silvestri collected by him on Mt. Baker, Wash., in 1931. Dr. Harlow B. Mills of the Montana State College has provided examples of *G. c. campodeiformis* Walker collected in Gallatin Canyon, Montana, in 1936. Dr. E. M. Walker of the University of Toronto has kindly loaned for study two pairs of the typical race of *campodeiformis* from the Canadian Rocky Mountains. The writer would express his appreciation to the above-named gentlemen, also to his colleague, Mr. Herbert S. Barber, for detailed information regarding the conditions under which *Grylloblatta barberi* Caudell was originally collected and their relation to the problem of natural barriers in the distribution of species. During this study specimens of all known forms, except *Galloisiana notabilis* (Silvestri), described from a single nymph collected in Japan, have been examined.

In the following key the more important character is men-

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tioned first in each couplet containing two or more characters. The word nymph refers to large, nearly mature specimens.

KEY TO THE GENERA AND SPECIES OF GRYLLOBLATTIDAE

1. Posterior-lateral angles of pronotum broadly rounded in adult (fig. 4); third segment of antenna more than twice the length of second segment (fig. 2); compound eyes somewhat reduced (fig. 2) or absent; cercus of adult composed of nine segments (fig. 3); front and hind femora shaped as in figs. 5 and 6, (Japan) . . . Genus *Galloisiana* Caudell.....2
... Posterior-lateral angles of pronotum narrowly rounded in adult (fig. 7); third segment of antenna not more than one and one-half times the length of second segment (fig. 9); compound eyes present and well-defined, general shape as in fig. 9; cercus of adult composed of eight segments (fig. 1 and 8); front and hind femora shaped as in figs. 10 and 11, (North America) . . . Genus *Grylloblatta* Walker.....3
(Genotype, *Grylloblatta campodeiformis campodeiformis* Walker, by monotypy.)
2. Compound eyes present . . . *Galloisiana*, subgenus *Galloisiana* Caudell (Type and only species, *Galloisia nipponensis* C. & K., 1924).
... Compound eyes absent . . . *Galloisiana*, subgenus *Ishiana* Silvestri (Type and only species, *Grylloblatta* (*Ishiana*) *notabilis* Silv., 1927).
3. Dorsal valve of ovipositor clearly reaching to middle of cercus, usually to the sixth segment (fig. 1); antenna of adult composed of 36 segments or less, of nymph[2] not over 30; cercus normally not exceeding 1.8 times the length of pronotum, (Alberta, Montana, Washington) 4
... Dorsal valve of ovipositor not reaching to middle of cercus, seldom beyond the fourth segment (fig. 8) (adult of *barberi* unknown); antenna of adult frequently composed of 39 or more segments, of nymph often of more than 30; cercus longer than above, normally 2 times or more the length of pronotum, (Northern California, Oregon).....5
4. Antenna of adult composed of 27-30 segments, of nymph seldom more than 26, (Alberta and Montana).....
.....*campodeiformis campodeiformis* Walker (1914)
... Antenna of adult composed of more than 30 segments, of nymph usually more than 26, (Washington).....
.....*campodeiformis occidentalis* Silvestri (1931)
5. Antenna of nymph composed of 36-40 segments; compound eye prominent, proportion of greatest length of eye to width of eye to width of head about as 1:4.4; color of body grayish brown, (Northern California).....*barberi Caudell* (1924)

[2] Reference is here made to large, nearly mature specimens.

... Antenna of nymph normally containing 31-32 segments; compound eye distinctly smaller than above, proportion of greatest length of eye to width of head about as 1:5.8; color of body light amber, paler than in *barberi*, (Oregon) .... *sculleni*, new species

The Genus GALLOISIANA Caudell

Galloisia Caudell and King, Proc. Ent. Soc. Wash., Vol. 26, pp. 53-60, 5 figs., 1924. (Genotype, *Galloisia nipponensis* C. & K., by monotypy.)

Galloisiana Caudell, *Ib.*, No. 4, p. 92, 1924. (New name for *Galloisia* C. & K., preoccupied by *Galloisia* Hustache, Bull. Mus. Paris, Vol. 26, fasc. 6, p. 493, 1920, in Coleoptera.)

Grylloblatta (*Galloisiana*) Silvestri, Boll. Lab. Zool. Scuola Sup. Agr., Portici, Vol. 20, p. 112, 1927.

Grylloblatta (*Ishiana*) Silvestri, *Ib.*, p. 113.

The genus *Galloisia* was proposed by Caudell and King for the species *nipponensis*, represented by one adult male and two nymphs collected by the junior writer in Japan. The original authors, in giving the generic diagnosis, emphasized the presence of lateral flange-like pads at the apices of the basal four segments of each tarsus. Other characters mentioned as being of probable generic importance were nine-segmented cerci, and a third antennal segment about three times the length of the second. Cerci of adult *Grylloblatta* are eight-segmented and, according to Caudell and King, the tarsi are cylindrical and lack pulvilli and lateral pads.

Crampton (1927) enumerated the above generic characters given by Caudell and King and accepted the Japanese species as probably belonging to a genus distinct from *Grylloblatta*. He also attributed generic significance to several characters taken from the specific description of *nipponensis*. He reported, however, that distinct tarsal pads, though smaller than in *Galloisiana*, are present in *Grylloblatta*.

Later in the same year, and being acquainted with Crampton's paper, Silvestri (1927) discussed the immature stages of two species collected in Japan. After comparing these with nymphs of *Grylloblatta campodeiformis* Walker (apparently adults of *Galloisiana* were not available for study) he placed *Galloisiana* as a synonym of *Grylloblatta*. The nymphs reported by Silvestri included three male specimens collected at the type locality of

nipponensis and identified as that species, and a single male nymph taken near Nagasaki (about 600 miles from Nikko, near where *nipponensis* was taken). This nymph was described as *Grylloblatta notabilis*, a new species and type of a new subgenus, *Ishiana*. *Ishiana* was particularly characterized by the absence of eyes.

In the present paper *Galloisiana*, with *Ishiana* as a subgenus, is reëstablished as a valid genus on the following grounds:

1. One of the two most important characters, in the writer's opinion, is the shape of the pronotum as shown in figs. 4 and 7. Nymphs of the two genera do not exhibit such differences in the outline of the posterior-lateral angles; but the adult *Galloisiana nipponensis* is very distinct from *Grylloblatta* adults in this respect, and, if the shape of the pronotum in this group is nearly as significant as in Dermaptera and Blattidæ, it is certainly of generic value.

2. The blind condition described for Silvestri's *notabilis* is not difficult to visualize after one examines the type material of *nipponensis*. The compound eye is elongate, as shown in fig. 2, and the outlines of the eye and its facets are obscure, in contrast to the differently-shaped conspicuous eye of *Grylloblatta* (fig. 9). It seems evident that there is a strong tendency toward the reduction of eyes in the known Japanese members of Grylloblattidæ. That they form a complex distinct from the Nearctic species is fairly clear. On the basis of the single reported nymph of *notabilis*, no change is justified other than to ally it with *Galloisiana* rather than *Grylloblatta*, because of its blindness. *Ishiana*, accordingly, is here considered a subgenus of *Galloisiana*. The discovery of the adult may indicate whether the species is blind in all stages and further show the proper placement of the species.

3. The different proportions of the third antennal segment in comparison with the second segment in the two genera are shown in figs. 2 and 9. The constancy of the character is demonstrated by the four American forms. The third antennal segment of *notabilis*, as figured by Silvestri (1927), is longer than in the corresponding stages of *Grylloblatta*. Since the two complexes indicate the stability of this character it is reasonable to consider proportional lengths of antennal segments of generic importance as they are in certain Dermaptera.

4. All records of adult Grylloblattidæ indicate the number of nine segments in the cercus of *Galloisiana* and eight in *Grylloblatta* to be constant, although, as noted by Caudell and King, the basal two segments are very closely united in *Galloisiana* (fig. 3). In Plecoptera the number of segments of the cerci is frequently of family significance and it seems advisable to consider even the relatively slight difference observed in the Grylloblattidæ, with respect to this character, as probably of generic value.

5: The spurs and spinelike setæ appear somewhat heavier in *Galloisiana*, and the legs (figs. 5 and 6) seem to be definitely stouter, than in *Grylloblatta* (figs. 10 and 11). These features will probably prove to be constant.

6. As stated by Crampton in 1927, adults of *Grylloblatta* preserved in alcohol show unmistakable lateral pads on the tarsus. Each pair of pads may represent a pulvillus which has become divided in the process of evolution. Although these pads are considerably smaller than those of *Galloisiana*, this character appears to be of minor value as compared to the shape of the pronotum and the reduction of the eyes. Unfortunately, the figures of tarsi shown by Caudell and King are somewhat misleading, since comparison is made between short, flattened segments of an adult *Galloisiana* (then called *Galloisia*) and elongate, cylindrical segments of a nymphal *Grylloblatta*. The tarsi of adults of *Grylloblatta* approach in form those of *Galloisiana*. The hind tarsi of *Grylloblatta*, particularly the basitarsi, appear more distinct from those of *Galloisiana* than the front and middle tarsi, which are very similar in the two genera. The incorrect statement that the tarsi of *Grylloblatta* lack pulvilli apparently originated with Walker's (1914) accidental use of the term "pulvilli," when he obviously meant "arolia," in the orignal description. Arolia between the claws are absent, and pulvilli are present on at least the fifth segment of front and middle tarsi, in both genera.

7. Since the elongate projection of the male supra-anal plate of *Galloisiana* is not present in *Grylloblatta*, it may be a valuable character. Until more information is available, however, the writer hesitates to consider specialization of genitalia as generic.

The Genus GRYLLOBLATTA Walker

Grylloblatta Walker, Can. Ent., Vol. 46, pp. 93-99, 1914. (Genotype, *Grylloblatta campodeiformis* Walker, by monotypy.)

Grylloblatta sculleni Gurney, new species

(Figs. 7-11)

Female: General form elongate, slender; body with fine pubescence. Head with parietal sutures well defined; lateral area with two spine-like setæ about mid-way along parietal suture, a slightly oblique row of four similar setæ mid-way between suture and lateral margin of head, about six setæ along margin of head at the occiput. Coronal suture and frontal sutures indistinct; two well-spaced setæ borne in each frontal suture. Postclypeus and anteclypeus plainly differentiated, their anterior margins slightly and evenly rounded. Labrum covered with fine setae. Compound eye sharply defined, distinctly smaller than antennal socket (fig. 9). Basal segments of antenna as illustrated (fig. 9), right antenna composed of 39 and left of 32? segments, respectively.

Pronotum as illustrated (fig. 7); the posterior-lateral angles narrowly rounded. Ventral-anterior margin of front femur with closely set row of about 16 stout spine-like setae; the ventral-posterior margin with about 6 weak, scattered setæ (fig. 10). Hind femur as illustrated (fig. 11). Tarsus of front leg with segments shorter than those of middle leg, segments of rear tarsi longest. Lateral flange-like tarsal pads at apices of first four tarsal segments (small but distinct); pulvillus well developed on apical segments of front and middle tarsi, lacking on hind tarsus.

Abdomen and appendages typical of the genus; gland on basal sternite well developed. Dorsal valves of ovipositor reaching about to base of fifth segment of cercus. Ovipositor and cerci as illustrated (fig. 8).

Coloration: General coloration light amber, ventral surface of body of a lighter shade than above. Setæ of body and appendages, tips of tibial spurs and tips of tarsal claws brown. Compound eyes black.

Measurements: Length of body, 23.0 mm.; of antenna, 17.0; of eye, 0.53; of pronotum, 3.15; of rear femur, 5.0; of dorsal valve of ovipositor, 3.45; of cercus, 7.2; width of head, 3.22; of pronotum, 2.63; of rear femur, 0.9.

In addition to the holotype described above, two adult females and eight nymphs, including a male 12 mm. in length, are considered paratypes. The apical antennal segments are broken from several specimens, the maximum number being 35 in the adults and 32 in the nymphs. The maximum head width is 3.15 mm. and 3.16 respectively in the two adult paratypes. The eye

length is 0.45 mm. and 0.58 in the two adult specimens. In other respects they agree essentially with the holotype.

Type locality. Scott Camp (6,600 feet, altitude), Three Sisters, Cascade Mountain, Oregon.

Type. No. 52017, U. S. National Museum.

The holotype female, one adult female paratype, and six small nymphal paratypes collected July 12, 1936, by H. A. Scullen and Robert Rider. One adult female paratype and two large nymphal paratypes collected at the type locality August 6, 1935, by H. A. Scullen and George Ferguson. Two adult and three immature paratypes are returned to Professor Scullen.

Professor Scullen, for whom this species is named, has furnished the following notes:

"On the day in question (August 6, 1935), the car was left at the C. C. C. camp located at what has for a long time been called Frog Camp, on the west side of the McKenzie Pass. From Frog Camp the skyline trail was followed to White Branch Meadow and from there to the snow line near Obsidian camp, at an elevation of about 6,600 feet. Within less than half an hour one immature specimen of *Grylloblatta* was found among the crushed rock at the border of the melting snow. Further searching brought to light an additional immature specimen. In both cases they were taken among the small particles of rock wet with the water from the dripping lower border of the snow. No additional specimens were taken in the neighborhood of this snow patch. Search was then made along the border of a more extended snow area, with the result that a mature female was taken among the broken pieces of rock close to the snow. No additional specimens of this group were taken during the two hours of collecting.

"There is no doubt that this insect is common if one can succeed in reaching its normal habitat. The difficulty, however, is in being able to dig under the shale rock for the specimens. I saw several adult specimens which I was unable to collect, because just at the instant I was ready to capture them a landslide of shale rock came down in my direction and I was compelled to give way."

Elsea (1937) has recently reported the collecting of two females of *Grylloblatta campodeiformis* near Crater Lake, Ore-

gon, on November 27, 1936. Although his specimens have not been examined, it seems probable that a form of *Grylloblatta* other than the typical race of *campodeiformis* is represented, perhaps *sculleni*.

Taxonomy and Bionomics of the Group

The accompanying key presents the distinguishing characters of the four known forms of *Grylloblatta* . The number of antennal segments has formerly been considered the most important specific character. In *c. campodeiformis* the number has not been reported previously in excess of 29, and since *c. occidentalis* exhibits 32-36 segments as now known, the latter form would seem to be valid. Among ten specimens of *c. campodeiformis* from Montana which have been examined by the writer are three with antennal counts of 29-30, 29-30, and 28-30 respectively; the others do not exceed 27 and some have broken antennæ. Although the naming of species in primitive orthoptera merely on the basis of a slight difference in number of antennal segments would seem to be a questionable practice, at present it seems best to recognize the two as distinct subspecies on the difference in the number of antennal segments.

The new species, *sculleni*, is clearly distinct from either form of *campodeiformis* on the basis of the ovipositor and cerci, as well as by the other differences given in the key. Although adults of *barberi* are not known, the maximum number of 40 antennal segments and the large dimensions of the cerci and femora in the nearly mature nymphs indicate its distinctness from *campodeiformis*, and its probable relation to *sculleni*. From the latter species *barberi* may be separated by the characters given in the key. The nymphal eye of *barberi* is larger than that of the adult *sculleni*. When adults of *barberi* are known other differences may become apparent. Until then, it seems best to describe *sculleni* as a distinct species; subspecific rank may later be advisable.

As mentioned by Crampton (1927), the right coxite of the male of *Grylloblatta c. campodeiformis* bears a dorsal process, illustrated by Walker (1919, fig. 8; 1922, fig. 69), which is not present in *Galloisiana*. Adult males of *c. occidentalis* agree with those of *c. campodeiformis* in this respect and no other genitalic differences have been found. Neither do the ovipositors of the

two forms show any appreciable differences.

Our knowledge of the biology of *Grylloblatta* is derived mainly from the following papers: Caudell (1923), Ford (1926, 1937), Silvestri (1931), Beamer (1933) and Mills and Pepper (1937). Specimens have usually been collected from beneath stones, pieces of wood, or other objects in cold surroundings, but snow has not always been present. Most collections have been made at altitudes of 5,000 feet or higher. The type locality of *barberi* is at an elevation of slightly more than 2,000 feet in the valley of the Feather River, at the base of Lassen Peak, Calif. Cold air from this mountain, which is over 10,000 feet in height, doubtless chills the nearby valley and provides suitable conditions for *Grylloblatta*. Mills and Pepper have suggested that the rock-strewn, talus slopes where *Grylloblatta* is most frequently found provide a means for the insects to select favorable living conditions by retreating back under the debris or advancing to the open air, to suit their own tastes. Available data suggest that the food may include some plant material and that in certain favorable stations insects that have been killed by the cold may be an important item of diet. Miss Ford (1937, p. 282) reports that under suitable laboratory conditions individuals "have lived for three and four years, slowly reaching maturity and depositing eggs." Mills and Pepper, as well as Miss Ford, have found *Grylloblatta* sensitive to temperature changes and prostrated by a degree of warmth in which most insects thrive. Buckle (1925) states that a specimen of *c. campodeiformis* showed signs of distress and soon died when placed in direct sunlight. It seems clear that, like the adults of the mecopteron *Boreus* and the tipulid *Chionea*, *Grylloblatta* is adapted to live normally in locations which are always near freezing. The Japanese *Galloisiana nipponensis* was taken in and beneath decaying logs and under conditions of cold, although snow was not present. Silvestri (1927) found that the alimentary canal of *nipponensis* contained arthropod remains.

The distributional data regarding *Grylloblatta* are still very fragmentary, but the evidence points to the presence of many widely separated, more or less isolated, units of population which may eventually be found to extend southward as far as New Mexico in the East and the San Bernardino Mountains of California in the West. The three forms in the Pacific Coast States are

distinct and the natural barriers rather clear. The Oregon species, *sculleni*, is separated from *G. c. occidentalis*, occurring on Mt. Baker, Wash., by the Columbia River Valley. *G. barberi* occurs in the Sierra Nevada Mountains in Plumas County, California, and is separated from its nearest Cascade relative by valleys in the watershed of the Klamath River. The known centers of distribution for *G. c. campodeiformis*, Banff, Alberta, and Gallatin Canyon, Mont. (reported by Strand, 1937, p. 38, fig. 7), are separated by about 500 miles, but in the same mountain range. Specimens from Emerald Lake and Mt. Edith Cavell, Alberta, agree with Montana individuals.

Since *Grylloblatta* is restricted to definite favorable habitats and has no means of rapid dissemination, it follows that the species are likely of ancient distribution. In this connection it may be observed that the two subspecies of *campodeiformis* are within or very near the limits of the main areas of glaciation during Pleistocene time, while the localities of *sculleni* and *barberi* were each characterized by separate and individual local glaciations. This fact gives added evidence for the distinctness of the Pacific Coast species.

Regarding the ordinal position of the Grylloblattidæ, it is purely a question as to how much the currently accepted orders are to be divided, which determines whether the order Notoptera (Crampton, 1915) should be accepted, whether it should be considered a suborder (Crampton, 1933, p. 102) of Orthoptera, or whether the group should be treated as a family of Orthoptera. Future morphological studies by Walker and others may give added weight to one belief; for the present the writer prefers to follow Hebard (1930) in treating the Grylloblattidæ as a family of Orthoptera. A number of ordinal names, in addition to Notoptera, have been proposed, chief among which are Grylloblattoidæ (Brues and Melander, 1915) which was later changed to Grylloblattodea (Brues and Melander, 1932), and Grylloblattaria (Bruner, 1915, p. 2). A full discussion of the phylogenetic relationships of the Grylloblattidæ is furnished by Crampton (1933).

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EXPLANATION OF PLATE

Fig. 1. *Grylloblatta campodeiformis occidentalis* Silvestri, lateral view of apex of female abdomen; Fig. 2. *Galloisiana nipponensis* (Caudell and King), lateral view of head; Fig. 3. Same, lateral view of apex of male abdomen; Fig. 4. Same, dorsal view of pronotum; Fig. 5. Same, lateral view of posterior surface of right front femur with associated trochanter and base of tibia; Fig. 6. Same, lateral view of anterior surface of left hind femur with associated trochanter and base of tibia; Fig. 7. *Grylloblatta sculleni*, new species, dorsal view of pronotum; Fig. 8. Same, lateral view of apex of female abdomen; Fig. 9. Same, lateral view of head; Fig. 10. Same, lateral view of posterior surface of right front femur with associated trochanter and base of tibia; Fig 11. Same, lateral view of anterior surface of left hind femur with associated trochanter and base of tibia.

EUDIAGOGUS PULCHER Fahr.

This attractive and well known weevil, which has previously been reported only from Florida, Texas and Jalapa, Mexico (Höge), has been taken in limited numbers at trap lights at Calexico, Imperial Valley, California, August 23, 1937, by J. K. Ellsworth. This extends its known distribution clear across our southern border. It feeds on senna (*Cassia occidentalis*) in Texas, according to Dwight Pierce.—Edwin C. Van Dyke.

CHANGE OF NAME

Nodocion solaster, nom. nov. This name is proposed to replace *Nodocion zelotoides* Chamberlin (American Museum Novitates, 1936, No. 853, p. 6) which is preöccupied by *Nodocion zelotoides* Worley (Ann. Ent. Soc. Am., 1928, vol. 21, p. 621). —Ralph V. Chamberlin.